

GENERAL INFORMATION						
Incident Classification: Track Conditions						
Incident Description: Track Geometry Defects – System Wide						
Date of Event: 3/6/2023		Time: N/A		Location: System Wide		Line: All
Route: N/A		Weather Conditions: N/A Temp: N/A		Involved Employee: MOW		
DPU Report#: N/A		Witnesses: N/A		Instruction Department Determination: N/A		
Industry Safe#: N/A						
Re-instruction: N/A		Discipline: N/A		MBTA Safety Investigator: Steven Culp sculp@mbta.com		
INJURY AND FATALITY INFORMATION						
Fatalities and Injuries	Employee	Passenger	Vendor/ Occupant	Pedestrian/ Motorist	Trespasser	Contractor
a. Injuries	0	0	0	0	0	0
b. Fatalities	0	0	0	0	0	0
PROPERTY DAMAGE & IMPOUND INFORMATION						
Property Damage (Dollar Amount): \$0.00						
Impound: No			Impound #: N/A			
What was Impounded: N/A Why: N/A			Impound requested by: N/A			
Evacuation: No			Service Interruption: None			
NTSB Notified: No	Time: N/A		Method: N/A		Case Number: N/A	
FTA Notified: No	Time: N/A		Method: N/A			

Summary:

On Monday, March 6, 2023, the Department of Public Utilities (DPU) conducted a site visit of the Red Line between Ashmont and Savin Hill. As part of that visit, a request was made for documentation that supports mitigation following recent geometry car tests. Due to the quality deficiencies in the documentation, on March 9, 2023, the MBTA Operations implemented a global speed restriction between 10-25 mph on the Red, Blue, Orange, and Green Lines until validation that all repairs were in place or verification that speeds were appropriate for those sections of track.

Incident Narrative:

On Monday, March 6, 2023, the Department of Public Utilities (DPU) conducted a site visit of the Red Line between Ashmont and Savin Hill. As part of that visit, they asked for documentation that supports mitigation following recent geometry car tests.

As a result of the MBTA's review of the documentation, and the quality deficiencies found in the documentation received, Interim General Manager Jeffery Gonneville directed Operations to implement a global speed restriction between 10-25 mph on the Red, Blue, Orange, and Green Lines until validation that all repairs were in place or verification that speeds were appropriate for those sections of track.

MBTA crews were dispatched into the field to conduct track inspections. In addition, six teams of consulting engineers were engaged to support these inspections.

- As of March 10, 2023, engineers had verified track conditions and the global slow orders were lifted on the Red, Blue, and Orange Lines. At the time, block speed restrictions on the heavy rail lines needed to be validated. The block speed restrictions represented 31.9% of heavy rail track. As each defect was validated and/or corrected, the length of the block speed restrictions would be reduced until the restriction could be fully removed.
- March 15, 2023, the global slow order was lifted on the Mattapan Line after engineers verified track conditions. The block speed restrictions represented 22% of Mattapan track.
- March 20, 2023, the Green Line global slow order was lifted after engineers verified track conditions. The block speed restrictions represented 17% of light rail track.

Findings

MBTA Safety Observations and Actions:

MBTA Safety initiated an investigation and worked directly with Engineering and Maintenance (E&M) and the Office of the Chief Engineer (OCE) to determine the parameters that contributed to the insufficient quality of the documentation of the track defects. MBTA Safety interviewed multiple people to obtain an understanding of the situation. This included conversations with E&M, MBTA Safety's consultant, and present and retired MBTA executives.

In general, those interviewed stated that they became aware of the issues with the geometry data after the DPU Request for Information for the most recent (February) and previous (August) geometry data. While reviewing the documentation, it was discovered that there appeared to be little to no follow-up after the August testing and that many items were reoccurring in the February data and reports.

MBTA Safety inquired on who was responsible for receiving and confirming the geometry data. Three of the five individuals were present or former Engineering and Maintenance executives. During their interviews, they stated that the Maintenance of Way (MOW) engineers are

responsible for scheduling and monitoring geometry testing, receiving and digesting the reports, and distributing them to the lines. At the point of information dissemination to the various lines, it becomes the responsibility of the line supervisors and section forepersons to confirm the data and direct the repairs and/or adjustments needed. The remaining two individuals that were interviewed stated that their understanding was that the main responsibility was with the line supervisors, but both individuals were not part of E&M.

Regarding the responsibilities of those interviewed with the geometry testing process, four of them stated that due to the chain of command that they were directly or indirectly responsible to ensure a process was being followed and issues were being acted on. The fifth individual did not fall into the E&M chain of command and had no past responsibility.

MBTA Safety questioned all with respect to the process followed in geometry testing. Everyone had a general understanding of the process. Those, both past and present, that were closer to the process were able to provide a more detailed, step-by-step description of the process.

All descriptions outlined that an outside vendor performed the geometry testing, and that the data was given to the MOW engineers for review, interpretation, and dissemination to the line supervisors. At this point, verification activities would begin to determine the validity of the data, focusing on the reported exceptions. When the exceptions were validated and defects were found, steps are taken to mitigate them. Mitigations are either administrative, such as placing a speed restriction, or physical, where a temporary or permanent resolution is put in place, such as gauge rods or repair/replacement of components.

The use of a “chase truck” was referred to several times during the conversation but not all interviewees knew this was part of the process. The purpose of the “chase truck” is to repair, if possible, any exceptions found while the testing is occurring. If repairs cannot be made, the MOW engineer or Section Foreperson can institute a speed restriction until a repair or replacement can be made.

An initial report and “brush chart” are generated at the completion of each geometry testing run. The MOW department is also able to validate the data based on these initial reports, but the vendors typically take up to 30 days to provide a cleansed report. If the initial reports are not utilized, it allows high priority defects that should be addressed immediately to remain unmitigated for up to 30 days.

MBTA Safety asked about gaps that have been identified in the geometry testing process. All stated that the process was not formalized and undocumented. It relies on knowledge being handed down from senior personnel to newer ones. This proposes an issue, as the number of senior personnel is decreasing through attrition (i.e., retirements, etc.). It was also shared that prior MOW management did not share information when they retired, and a good deal of institutional knowledge left the MBTA with them.

Secondly, and due to there not being a documented process, there isn’t always a clear follow through to ensure that exceptions are validated and addressed. Once the MOW engineers hand

off the data, the line personnel manage it. There are inconsistencies on how each individual processes the data, based on the on-the-job training received. There is no communication back to the MOW engineers or department leaders to know that exceptions have been addressed. To address this, one person proposed that 3rd party validation be part of the documented process, at least until such time that the data being submitted by the vendors is showing 90% accuracy.

Additional gaps were discussed when reviewing the proposed probable cause and contributory factors as outlined below. Track standards were identified as an issue. MBTA's track standards are based on a variation of Federal Railroad Administration (FRA) standards because that was what was available as a reference when many transit systems developed and adopted their own standards. These standards do not account for legacy transit systems that were designed and built before they were developed, and in configurations that are quite different from those systems the FRA standards were developed for.

Further, the programs utilized by most geometry testing vendors is designed for freight railroads (FRA standards). This proposes an issue because the algorithms are designed for long radius curves versus MBTA's short, tight radius curves. These algorithms identify exceptions even though the track is with MBTA standards. If these programs were redesigned to account for MBTA's configurations, fewer exceptions would be initially identified and would allow MOW resources to dedicate more time on addressing actual exceptions versus validating exceptions to determine if that are real or "ghosts".

As noted previously, due to attrition (retirements, promotions to departments outside of MOW) a great deal of institutional knowledge disappears. An organizational opportunity was identified where succession planning for key roles should be instituted. Lack of the Director and/or the Deputy Director positions may have also had a detrimental effect on overall department management. Presently, the Director position remains unfilled for 9+ months.

Additionally, talent retention is difficult. Many employees learn skill sets within Engineering and Maintenance, such as project/contract management, and discover that other MBTA departments offer greater compensation for these skills and move to these other departments. As a result, E&M/MOW needs to train new individuals on these skills.

Lastly, training for all levels of the MOW department was identified as an opportunity to ensure that all affected personnel understand the geometry process and the tools available to them to accurately perform the mission of the department.

Based on the discussions and information reviewed, MBTA Safety offers the following findings:

- **Insufficient Contract Definition and Management**
 - Understanding the assumptions that are programmed into software. Although the parameters that the geometry vendors utilize are defined, when questioned, no one could articulate what assumptions that RailPod and Mermec (the two geometry vendors) utilized as part of their software that analyzes the data for those parameters.

- Consistency of utilizing a single vendor. The data provided by multiple vendors is not consistent and makes it difficult to determine trends. This was based on MBTA Safety's consultant's interviews. MBTA will need to determine a procurement method that will allow this.
- The RFP for track geometry testing requires a checklist which includes a list of requirements for the provider to comply with to ensure that MBTA is getting the testing and data that it requires. MBTA Safety's consultant was told that this checklist is not being completed in the contracts provided.
- MBTA needs to clean up data versus being provided clean data due to programming deficiencies. Both MERMEC and RailPod have issues with data that should be deleted from the defect lists. One of the MOW Engineers recognizes these issues and can explain most of them, but the geometry provider should be removing them during testing so that the data files represent the most accurate data possible and there will be fewer defects that cannot be verified.
- Contract/project management of the process is placed on the MOW Engineers versus experienced project managers.
- Review of Track Standards (versus adopting published values as a default). MBTA's standards appear to utilize FRA values used as defaults and should be based on MBTA vehicles and track configurations. MBTA has a lot of track conditions that do not comply with the FRA limits. Revising these standards may reduce the number of false positive defects reported.
- Confirm Adequate Training, including the process of geometry testing data validation and the use of specialized equipment (i.e., Geismar Amber and Speedliner). Although MBTA has more than one of these very useful tools, it was not confirmed that all affected MOW employees were familiar with them or had been trained on them.
- Ensure that employees are heard when they understand track issues and have ideas for resolution to propose. Some of data that is received can be confusing and personnel have suggestions to display it in a manner that is less confusing, but it does not appear that there is an outlet to share those ideas.

Conclusion

After reviewing all pertinent files and interviews, MBTA Safety concludes the following:

SSOR Probable Cause Category: Operating Rule Violation/Human Factor (employee error or organizational issue)

Probable Cause(s):

Based on the findings, the probable cause that allowed the condition of insufficient documentation to exist has been determined to be the lack of a documented process. The absence of a documented process allows for many tasks to be overlooked.

Contributory Factors:

As noted in the findings, the following factors also contributed to this condition:

- Limited MOW senior management during the period between October 2022 and the initiation of this investigation.
- Contract Definition and Management
- Track Standards that are not specific to MBTA's system (versus adopting published values as a default).
- Adequate Training, including training on the documented process to be utilized and the use of specialized equipment (i.e., Geismar Amber and Speedliner).
- Ensuring that employees are heard when they understand track issues and have ideas for resolution to propose.

Actions Taken:

- Creation of a Systemwide Speed Restrictions Management Plan. This performance plan is a living document that will grow and evolve as it guides MBTA through the process of addressing defects and removing speed restrictions. This document lays out the roles and responsibilities that are expected.
- Multiple Pulse Checks, Daily, to ensure that the Systemwide Speed Restrictions Management Plan is being implemented as designed, and to provide input to adjust it as needed.
- Ensuring that prior to a geometry speed restriction being lifted, that the defects are mitigated and reviewed by line supervision, MOW Engineering, and MOW leadership. Upon concurrence, a recommendation to the Chief of Engineering and Maintenance, the Acting Chief Engineer, and Chief of Safety Engineering and Construction is made (with back-up data) to release or modify the restriction.

MBTA Corrective Actions:

Recommended corrective actions are as follows:

- Develop and implement a process document for geometry testing, including training for affected employees.
 - Completed and published on June 16, 2023.
- Develop track standards specific to MBTA vehicles and track configurations.
- Incorporate new standards into geometry testing vendor contracts.
- Ensure adequate staffing at all levels as determined by Department head and leadership.

- Develop program for succession planning to ensure institutional knowledge is retained, as well as a method to retain resources.
- Institute a suggestion program to allow employees ideas to be shared.

Attachments:

Tab A: Track – Preventive Maintenance Inspection Standard Operating Procedure

TAB A



TRACK – PREVENTIVE MAINTENANCE INSPECTION STANDARD OPERATING PROCEDURE

Track - Geometry Inspection Response

EM-MOW-GEO-INSP-SOP-2023-0.0

June 16, 2023

Revision No. 0.0

This procedure is the property of the Massachusetts Bay Transportation Authority. It must not be reproduced in whole or in part or otherwise disclosed without prior written consent.

The official controlled copy of this procedure is the digitally signed PDF document held within our network server and visible to all authorized users. All printed copies, and all electronic copies and versions, except the one described above, are considered uncontrolled copies which should be used for reference only.



DOCUMENT CONTROL

DOCUMENT NO.	EM-MOW-GEO-INSP-SOP-2023-0.0
DOCUMENT TITLE	TRACK – PREVENTIVE MAINTENANCE INSPECTION STANDARD OPERATING PROCEDURE - GEOMETRY INSPECTION RESPONSE
RELEASE DATE	06/16/2023
REVISION AND STATUS	REV 0.0
FILENAME	EM_MOW_GEO_INSP_RESP_2023-0.0
Prepared For	Joe Cheever, Chief E&M
Reviewed By	Arzu Kurkoglu Hemann, Deputy Director, MOW
Reviewed By	William Boyce, Senior Director, Reliability Engineering
Reviewed By	Mark Molewyk, Director, Quality Management
Distributed To	MOW Personnel

REVIEWED AND AUTHORIZED BY:

<div>DocuSigned by:</div> <div>Arzu Kurkoglu Hemann</div> <div>24B1212FF97E43B...</div>	6/16/2023	Arzu Kurkoglu Hemann Deputy Director, MOW
<div>DocuSigned by:</div> <div>Mark Molewyk</div> <div>1A15CD3CE108416...</div>	6/16/2023	Mark Molewyk Director, Quality Management
<div>DocuSigned by:</div> <div>Ronnie Valdivia</div> <div>ED7CBC1AB0C94CB...</div>	6/16/2023	Ronnie Valdivia Director, Asset Management
<div>DocuSigned by:</div> <div>Will Boyce</div> <div>CA9BBEDDD0A45D...</div>	6/16/2023	William Boyce Senior Director, Reliability Engineering
<div>DocuSigned by:</div> <div>Joseph Cheever</div> <div>16782C0149094F7...</div>	6/16/2023	Joseph Cheever Chief, Engineering & Maintenance Infrastructure

REVISION HISTORY

REVISION	COMMENT	PUB. DATE	EXP. DATE
0.0	Original	06/16/2023	



CONTENTS

1 INTRODUCTION4

1.1 Purpose..... 4

1.2 Application and Scope 4

2 PROCEDURE4

2.1 Process Overview 4

2.2 Exceptions..... 9

2.3 Control Points..... 9

2.4 Results..... 10

2.5 Frequency 10

2.6 Material 10

2.7 Equipment 10

2.8 Required Safety Protocols and Personal Protective Equipment 11

3 COMPLIANCE11

3.1 Compliance Review 11



1 INTRODUCTION

1.1 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to define the process, duties and requirements following a track geometry evaluation, for responding to exceptions recorded by the inspection.

The following organizational and regulatory requirements define the requirements for this procedure:

- Massachusetts Department of Public Utilities (DPU), Code of Massachusetts Regulations (CMR), 220 CMR 151
- 49 US Code of Federal Regulations (CFR), §213.231 – §213.241 – Track Inspections
- 49 CFR §659.13 – §659.43 – Role of the State Oversight Agency
- 49 CFR §674.27 – State Safety Oversight Program Standards
- MBTA Track Maintenance and Safety Standards (Green Line - 2008)
- MBTA Track Maintenance and Safety Standards (Blue, Orange, and Red Lines - 2008)

1.2 APPLICATION AND SCOPE

This MBTA SOP is applicable to the Maintenance of Way (MOW) Division within the Engineering and Maintenance (E&M) Department of the MBTA.

This SOP is applicable to all MBTA Light (Green Line) and Rapid (Orange, Blue, and Red Lines) Rail transit mainline track.

This SOP addresses MOW responsibilities, actions to be taken and associated time frames upon receipt of track geometry evaluations.

2 PROCEDURE

2.1 PROCESS OVERVIEW

To ensure that the geometry of MBTA track is being maintained within acceptable spatial limits, the MBTA hires a vendor to perform Track Geometry Inspection in accordance with applicable organizational and regulatory requirements. These inspections are performed semi-annually on heavy rail and quarterly on light rail, and measure several geometry parameters such as gauge, cross level, alignment, and profile, among other types of defects. It is mandatory that the inspection is performed in the presence of an MBTA employee, preferably the Track Engineer, with no exception. After a Track Geometry Inspection is completed, a report of exceptions to the MBTA Track Maintenance and Safety Standards is provided by the vendor to MOW. It is then MOW's responsibility to assess and respond to the findings of the report to ensure the safe operation of trains over revenue track.

MBTA E&M | GEOMETRY INSPECTION RESPONSE



STEP	ACTIVITY	PERFORMED BY	TIMING
1	<p>PMI is Scheduled with Vendor</p> <p>Coordinate with the Vendor to determine the inspection schedule for the specific line to be tested. <i>*This process may occur months in advance of the actual inspection taking place and is based on track and vendor availability.</i></p>	Track Engineer	May occur months in advance of the inspection
2	<p>Work Order is Generated</p> <p>Generate and assign inspection work order in accordance with requirements established in the SOP for Managing PMI Work Orders in Trapeze.</p>	Track Engineer	Before inspection begins
3	<p>Right of Way (ROW) Access</p> <p>Request and obtain access to Right of Way (ROW) from Operations Control Center (OCC) Dispatcher in accordance with requirements established in the Right of Way (ROW) Safety Rulebook.</p>	Track Engineer	Before Entering ROW
4	<p>Track Geometry Testing and Inspection</p> <p>Conduct the Geometry Track Inspection in accordance with the specifications set in the MBTA E&M MOW Directorate Specifications for a Non-Contact, Automated Track Geometry Inspection Service document. <i>*The Vendor collects data measurements of the following raw data channels:</i></p> <ul style="list-style-type: none"> ▪ Distance along track ▪ Curvature ▪ Super-elevation (long wavelengths) ▪ Cross-level (short wavelengths) ▪ Gauge ▪ Gauge variation ▪ Left and right surface ▪ Left and right rail alignment ▪ Twist ▪ Warp 	Vendor	<p>Inspection work is performed</p> <p>Note: This is a datum for follow steps to reference their relative timing to.</p>



STEP	ACTIVITY	PERFORMED BY	TIMING
5	<i>Exceptions Logged During Testing and Inspection</i> During testing, Track Engineer on board will relay via text all Wide Gauge exceptions $\geq 57 \frac{3}{4}$ " and all Gauge Variation exceptions $\geq 1 \frac{3}{8}$ " (LRT only) to the Night Supervisors and Section Foreperson for immediate verification and mitigation, if required.	Track Engineer Section Foreperson Night Supervisor	During Testing (Step 4)
6	<i>Vendor Exception Report</i> Receive geometry exception reporting from Vendor in .txt or .csv format and forward vendor reporting to line supervisors and section forepersons	Track Engineer	Daily, directly following testing (Step 4)
7	<i>Exception Comparison Report Generated</i> Generate excel spreadsheet with exception data provided by Vendor for exception tracking purposes: format value column to inches add & populate column for location description add & populate columns for defect speed, line speed, & current restricted speed add columns for field verification: EMP / MEASUREMENT / G Y R / MARKER Upload file to remotely accessible shared file	Track Engineer	From receipt of exception report (Step 6): RTL & HSL within 12hrs LRT Within 24hrs



STEP	ACTIVITY	PERFORMED BY	TIMING
8	<p><i>Perform Exception Comparison Report</i></p> <p>Perform exception comparison report against previous inspection in uploaded file.</p> <p>Classify exceptions into following categories:</p> <ol style="list-style-type: none"> 1) new / restrictable 2) previous / restrictable / found / > previous threshold value. 3) previous / restrictable / not found / > previous threshold value. 4) new / non-restrictable 5) previous / non-restrictable / found / > previous threshold value. 6) previous / non-restrictable / not found / > previous threshold value. 7) previous / restrictable / not found / ≤ previous threshold value. 8) previous / restrictable / found / ≤ previous threshold value. 9) previous / non-restrictable / not found / ≤ previous threshold value. 10) previous / non-restrictable / found / ≤ previous threshold value. <p>Confirm appropriate speed restriction in place for classifications 2 & 8 (from Step 8)</p>	Track Engineer	<p>From receipt of exception report (Step 6):</p> <p>RTL & HSL all classifications within 24hrs</p> <p>LRT classifications 1, 2, 3, 7, 8 within 48hrs classifications 4, 5, 6, 9, 10 within 96hrs</p>

MBTA E&M | GEOMETRY INSPECTION RESPONSE



STEP	ACTIVITY	PERFORMED BY	TIMING
10	<p>Verify Exceptions in the Field</p> <p>Record measurement, chain marker and line/restriction speed at each exception</p> <p>Confirm code (G,Y,R) of each verified exception</p> <p>Notify Line Supervisor after validation of restrictable exception and document.</p> <p>If exceptions have not been verified within agreed upon timing, implement a mitigation before field verification.</p>	<p>Section Foreperson</p> <p>w/ Track Engineer assist</p>	<p>From receipt of exception report (Step 6):</p> <p>All urgent (R) coded restrictable within 24hrs</p> <p>RTL & HSL classifications 1-3 within 2 business days</p> <p>classifications 4-6 within 4 business days</p> <p>LRT classifications 1-3 within 5 business days</p> <p>classifications 4-6 within 10 business days</p>
11	<p>Mitigate Restrictable Defects</p> <p>Immediate repair, speed restriction placement, or removal of track from service</p> <p>Update shared file with confirmed classification and mitigation</p> <p>Create service requests for classification 1 exceptions in Trapeze EAM</p> <p>Update previous service requests with latest exception findings</p>	Line Supervisor	Upon notification
12	<p>Conclude Campaign</p> <p>Prepare and submit final notification to the MOW Director that all exceptions are mitigated</p> <p>Prepare for a meeting with the TGV Vendor to improve processes (i.e. false positives, repeat findings)</p>	RTL or LRT Superintendent	<p>From receipt of exception report (Step 7):</p> <p>Within 30 business days</p>



STEP	ACTIVITY	PERFORMED BY	TIMING
13	<i>Close out Work Order</i> Review the completed Track Geometry Inspection PMI work order for completeness, ensure all documentation has been uploaded to Trapeze, and close out the work order.	Line Supervisor	Upon Review of Reports
14	<i>Quality Management Audit</i> Perform audit of the inspection in accordance with the Quality Management Plan's (QMP). All steps outlined within this SOP are subject to audit and should follow the minimum quality criteria outlined in the QMP.	Quality Management	2 weeks after close of quarterly inspection

2.2 EXCEPTIONS

An exception to performing this PMI on its predetermined schedule may be taken, with the approval of the Director of Maintenance of Way, in the event that the ROW is deemed inaccessible due to inclement weather, operational requirements, use of observation trains, emergencies, or unsafe conditions. The Track Engineer that is accompanying the Vendor notifies the Section Foreperson or Line Supervisor if an inspection could not be completed due to extenuating circumstances.

2.3 CONTROL POINTS

The following section identifies where risks in the process could occur and control points to mitigate the risk. Note that the step in the table below corresponds with the step outlined in section 2.1 of this document.

STEP	RISK	CONTROL POINT AND RISK MITIGATION
3	Vendor is unable to gain ROW access.	It is the responsibility of the Track Engineer to coordinate and secure the Vendor's access to the ROW in accordance with requirements established in the Right of Way (ROW) Safety Rulebook.
4	Vendor is unable to complete PMI.	The Track Engineer is responsible for rescheduling the inspection to be completed on the next available date.
All	Unsafe work conditions identified.	Use the "Good Faith" Safety Challenge. Section 2.2.5 of the Right of Way (ROW) Safety Rulebook states that: "The employee, accompanying the Vendor, must immediately report any unsafe condition to the OCC Dispatcher, their immediate Supervisor and/or an Official orally and follow-up with a written report to his/her Supervisor within twenty-four (24) hours of the Safety Challenge. Where possible photos/video footage is captured at its precise location for follow up and investigation purposes."



2.4 RESULTS

The reports supplied to MBTA are to include all the data collected for the Blue, Orange, Red, and Green lines on gauge, gauge variation, profile, super elevation, cross level, curvature, twist, warp, and alignment. The final report must include an exception report with MBTA-defined parameters, outlined in the MBTA E&M MOW Directorate Specifications for a Non-Contact, Automated Track Geometry Inspection Service document. Exception reports and strip charts must be measured in engineering stationing (feet), not mile posts, synchronized with posted wayside signage. Exceptions detected by the Vendor must be easily located on the charts by displaying a visual representation of the exception.

2.5 FREQUENCY

MBTA specifies that geometry testing performed on the Green Line is to be conducted on a quarterly basis. Following industry best practices, completion of the inspection may be up to but not more than nine days before or after scheduled due date (10% of scheduled frequency).

Geometry testing performed on the Orange, Blue, and Red lines is to be conducted on a semi-annual basis. Completion of the inspection may be up to but not more than 18 days before or after scheduled due date.

2.6 MATERIAL

All required consumables used during the Geometry Track Inspection, such as fuel, lubricants, filters, and recording media, are provided by the Vendor.

2.7 EQUIPMENT

The system for measuring and testing of the track shall be a Contractor self-propelled hi-rail vehicle and/or portable Contractor measurement and test equipment installed on Authority GL truck (Green Line testing only). Contractor shall be responsible for all engineering of, materials and attachment of Contractor portable equipment onto Authority GL trolley truck. All manpower and equipment necessary to complete the testing shall be provided by the Contractor.

Hi rail vehicle shall be furnished, operated, maintained and powered by the Contractor. Hi rail vehicles shall be self-propelled, diesel powered, capable of on/off tracking at standard grade crossings, meeting local, state and federal regulations. All components of the vehicle must fall within the clearance envelopes provided and clear all obstructions throughout the MBTA Right of Way, including third rail, platforms, tunnels and signals. Vehicle shall be able to negotiate curved track geometry locations as tight as 75' radius in restrained conditions. Additionally, vehicle shall possess the necessary traction power to go up and braking control to go down a grade of eight percent (8%). Vehicle shall have room to carry at least two (2) MBTA employees. Vehicle must be measured and certified by MBTA Maintenance of Way Track Engineers prior to the starting of testing.

All components of the self-propelled geometry testing hi-rail vehicle and the testing equipment must fall within the clearance envelopes provided. This is critical as the RT and LRV trains are electrically powered, using third rail and catenary power, which may remain energized during testing.



2.8 REQUIRED SAFETY PROTOCOLS AND PERSONAL PROTECTIVE EQUIPMENT

The Vendors performing the tests and inspections comply with all established safety rules, procedures, and practices according to the latest applicable standards including the latest editions of the Right of Way (ROW) Safety Rulebook, the Personal Protective Equipment Program, the E&M Policy for Personal Protective Equipment on the Right of Way, and the Job or Area Hazard Analysis (process underway).

The Vendor follows the requirements set in the Policy for Personal Protective Equipment on the Right of Way. The Vendor is responsible for providing and maintaining personal protective equipment (PPE) required to protect its employees from injury or harm during performance of the procedure.

PPE required for this PMI follow the requirements established in the latest version of the following standards:

- Right of Way (ROW) Safety Rulebook
- Personal Protective Equipment Program (Safety Program: SP19-001)
- E&M Policy for Personal Protective Equipment on the Right of Way

3 COMPLIANCE

3.1 COMPLIANCE REVIEW

The MOW Deputy Director and ultimately the MOW Director are responsible for validating that the Geometry Track Rail Inspection Response was properly conducted, mitigations have been properly documented, and that the requirements of this SOP have been met.